

Durian

Robert E. Paull¹ and Saichol Ketsa²

¹Department of Tropical Plant and Soil Sciences, University of Hawaii at Manoa, Honolulu, HI

²Department of Horticulture, Kasetsart University, Bangkok, Thailand

Scientific Name and Introduction: The durian (*Durio zibethinus* Murray (Syn. *D. acuminatissima* Merr)) is often referred to as the 'King of Fruits' in South-East Asia. However, its qualities promote considerable discussion because of its odor, that is offensive to some. The genus specific *zibethinus* is derived from the Italian 'zibetto' for the civet, a cat-like animal with a musky smell. The fruit has a strong onion-garlic odor. This tropical tree is mainly cultivated in Sri Lanka, Southern India, Southern Burma, Thailand, Cambodia, Vietnam, Malaysia, Indonesia, Borneo, Mindanao (Philippines), and New Guinea. It has been spread throughout the tropical world, with the general name of durian (Indo-Malay) or variants of duren (Indonesian), duyin (Burmese), thureen (Cambodian), thurian (Thai), saurieng (Vietnamese), dulian (Philippines), stinkvrucht (Dutch), and kadu (Sudan). Limited supplies are available from the Caribbean, and Central and South America. Commercial supplies are available from Thailand and Malaysia.

Quality Characteristics and Criteria: The oval or ellipsoid green to brownish fruit weighing up to 8 kg (18 lb), can be up to 30 cm (12 in) long and 20 cm (8 in) in diameter densely covered with stout sharp pyramidal spines (0.5 in; 1 cm) on a thick fibrous rind. Fruit are divided into 3 to 5 smooth walled compartments, each containing one to six glossy, creamy to red-brown seeds 2 to 6 cm (0.8 to 2.4 in) long, covered by a white to yellowish soft sweet pulp (aril). The pulp can be odorless or have a strong odor suggesting garlic, onion, or strong cheese with a fruity background. The edible pulp (20 to 35% total mass) has a smooth firm custard-like texture. In some fruit, seeds are rudimentary or small compared to wild types.

Quality criteria include an pulp with sweet flavor and a good texture, few or small seeds, large aril percentage and marketable weight of 1.5 to 3.5 kg (3.3 to 7.7 lb), elongated to round shape, good shelf-life, good rind color and thickness, reduced rind dehiscence and freedom from disease and insects. Superior varieties have thick, yellow, fiberless, and firm pulp.

The Thai variety 'Chanee' has stronger aroma and is smaller than the preferred 'Monthong' (Golden Pillow). Malaysian varieties include; D-2 'Dato Nina,' D-7 'Repok B-2,' D-10 'Durian Hyan,' D-24, and D-98 'Katoi.'

Horticultural Maturity Indices: At maturity, the fruit naturally falls (abscises) from the tree at the articulation of the fruit stem with the fruit, then ripens in 2 to 4 days with the fruit normally splitting into segments of irregular width at the stylar end. Ripening results in an increase in soluble sugars, a decrease in starch and pulp firmness which have occurred before natural fruit splitting (dehiscence) starts.

To prevent natural fruit fall (abscising), fruit may be tied to the limb or harvested at maturity. Maturity is judged by appearance (fruit stalk thickness and flexibility, abscission zone, or carpel sutures), number of days from flowering and a hollow sound when tapped with the wood or rattan stick or knife. Days from flowering and tapping are the most reliable criteria (Siriphanich, 1996). 'Chanee' durian takes 2 to 4 days while 'Monthong' durian takes 4 to 6 days to ripen after harvest depending maturity. Fruit at 85% maturity, based upon days from anthesis and rind characteristics, ripen to excellent quality in < 1 week at 28 to 31 °C (82.4 to 87.8 °F). Ripening takes longer than 1 week at 22 °C (71.6 °F). Fruit that are 95% mature when harvested have already commenced ripening, while 75% mature fruit may ripen with an inferior quality. Fruit collected from the ground after falling are more subject to disease, fracture, and have a short shelf-life (2 to 3 days), instead of the 7 to 8 days if picked from the tree. In Thailand, the fruit is harvested with the stem (peduncle) attached and the fruit stem is wrapped in a leaf or paper by

retailers to reduce wilting and maintain the fresh appearance of the stem whose appearance is also used as a measure of fruit freshness. 'Chanee' is at optimum eating stage for only a few days while 'Mon Tong' is at this stage for a longer period.

Grades, Sizes and Packaging: Fruit are graded on weight, shape, size, and defects (Nanthachai, 1994). Defects include disease, insects, mechanical injury, and flesh disorders. The grades vary with variety (Hiranpradit et al., 1992). The fruit is packed into cardboard cartons (4 to 6 fruit per carton), or in cartons fitted with fiberboard dividers.

Pre-cooling Conditions: Use forced-air or room-cooling to 15 °C (59 °F).

Optimum Storage Conditions: This climacteric fruit, when stored at 15 °C (59 °F) has extended shelf-life (Brooncherm and Siriphanich, 1991); RH of 85 to 95% is best (Sriyook et al., 1994; Ketsa and Pangkool, 1994). Fruit can be waxed to reduce water loss (Sriyook et al., 1994). Fruit ripened at a lower RH (75%) have a better eating quality that is less juicy and easier to dehusk than fruit ripened at higher RH (Ketsa and Pangkool, 1994).

Controlled Atmospheres (CA) Consideration: Ripening is inhibited by 2% O₂ and fruit fail to ripen when removed to air. Fruit stored in up to 20% CO₂ in air did not affect ripening or quality (Tongdee et al., 1990). Low O₂ (10%) reduces respiration rate and ethylene production but does not affect the onset of ripening, and ripe fruit quality is not affected. The aril remain hard in less mature fruit stored in 10% O₂ and 15 or 20% CO₂. The commercial potential of CA or MA is still unclear (Siriphanich, 1996).

Retail Outlet Display Considerations: Display at ambient temperature or hold at 15 to 18 °C (59 to 64.4 °F), if available. Do not mist or ice. Avoid mixing during storage with other produce. The husk can be removed and the whole pulp and seed segment can be removed and sold in trays with a plastic over-wrap. Remove husks as soon as durian produces aroma or is half-ripe and the pulp is still firm. If fruit splitting has started, the pulp is generally too soft and has a very short shelf-life.

Chilling Sensitivity: The pulp of half to near full ripe fruit is much less sensitive to chilling injury than the peel, and the pulp can be stored for 4 weeks at 5 °C (41 °F). Whole fruit stored at less than 15 °C (59 °F) develops chilling injury shown by the peel turning black or dark brown starting at the groove between the splines (Brooncherm and Siriphanich, 1991). Chill injured pulp suffer a lose of aroma, does not soften and may develop sunken areas on the surface (Siriphanich., 1996).

Ethylene Production and Sensitivity: Production varies from near zero in immature fruit up to 40 F1 / kg·hr at the climacteric peak and varies with variety (Tongdee et al., 1987a; 1987b). Most of the ethylene production is associated with the husk, as the pulp has a very low rate (Siriphanich, 1996). Durian can be ripened with ethylene gas (Ketsa and Pangkool, 1995) or ethephon (Atantee, 1995). The husk of ripened durians will turn yellowish to brownish if the ethylene concentration is too high. Thai consumers prefers to buy naturally ripened durians as the husk remains light green or olive, while durians with a yellowish or brownish husk are not regarded as fresh. In Thailand, many growers, wholesalers or retailers ripen durians by a quick dip of the fruit stalk (peduncle) into a ethephon solution (3000 µL L⁻¹ or higher). This approach saves on ethephon use and prevents development of yellowish or brownish husks. Ethephon use postharvest is not approved in the US.

Respiration Rates: 80 to 450 mg (45 to 254 µL) CO₂ kg⁻¹ h⁻¹ at 22 °C.

To calculate heat production, multiply mg kg⁻¹ h⁻¹ by 220 to get BTU per ton per day or by 61 to get kcal per metric ton per day.

The peel has a much higher respiration rate and ethylene production than the pulp (Brooncherm and

Siriphanich, 1991). The climacteric rise seems to occur first in the pulp. For 'Chanee' and 'Kan Yao' the respiratory and ethylene peaks plateau or decline when the fruit is overripe, while in 'Mon Tong' the peak occurs when overripe (Tongdee et al., 1987b).

Physiological Disorders: Failure of the aril to soften or to soften unevenly is a frequently observed disorder. Another disorder leads to a watery aril with a flat and dull taste and occurs especially during the rainy season. The cause of both disorders is unknown (Nanthachai, 1994).

Postharvest Pathology: *Phytophthora* spp. is a major cause of rot in immature and mature fruit that leads to high losses during rainy weather and if fruit come in contact with soil. Another major cause of fruit rot is *Lasiodiplodia* spp. (Tongdee et al., 1987a). Fruit on the ground can also be attacked by *Sclerotium rolfsii*. Fruit diseases due to *Phomopsis*, *Collectrichum*, *Fusarium* and *Rhizopus* are sometimes severe (Siriphanich, 1996). Sanitation, avoidance of mechanical injury and fungicide can be used for control (Lim, 1990).

Quarantine Issues: If the skin is not broken or split, durian is not a fruit fly host. The skin must be free of other insects such as scales.

Suitability as Fresh-cut Product: The fruit is most frequently eaten fresh. The aril contains 64% water, 2.7% protein, 3.4% fat, 27.9% carbohydrate, and 23 mg/1000 g Vitamin C. Choice varieties demand and receive higher prices than other varieties. Road side and market stalls may cut open the fruit and package the soft aril and seed in a shrink or stretch wrapped tray. Ripe fruit and soft arils are also frozen for export. Partially ripe fruit are difficult to open without damaging the pulp.

Special Considerations: Thailand is the largest producer followed by Indonesia and peninsular Malaysia. The fruit is highly prized in the markets of South-East Asia. Consumers in Singapore preferring fully ripe fruit with no splitting, while Thais prefer the firmer pulp of less ripe fruit with less volatiles. Others prefer the strong flavored durian over the milder cultivars. There is a demand among ethnic groups, familiar with the fruit, in large temperate cities.

The pulp is dehydrated and sold as 'durian cake,' boiled with sugar, fermented or salted. The dried aril is used as a flavoring in ice cream, confectionery, pastry, and soft drinks (Nakasone and Paull, 1998).

Boiled or roasted seeds are eaten as snacks. Durian chips can be made from the immature and unripe durian pulp, as the lighter color flesh makes more attractive chips.

Do not ship with mixed loads.

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